

PH.D. PROGRAM IN BIOLOGY - THE CITY UNIVERSITY OF NEW YORK  
FIRST EXAMINATION - ECOLOGY AND EVOLUTIONARY BIOLOGY  
FALL 1986

Session I. Short factual questions. Answer 10 of the following 12 questions. One brief paragraph should be used to answer each question.

1. What information is required to construct logistic and exponential models of population growth.
2. Describe the key differences between sympatric, allopatric and parapatric speciation.
3. What are the assumptions of the Hardy-Weinberg model, and how is this model used in population studies.
4. Compare the Eltonian and Hutchinsonian concepts of the niche.
5. What is species diversity? What are two major components of indices of species diversity?
6. Distinguish between stabilizing, directional and disruptive (diversifying) selection.
7. What are the two major types of reproductive isolating mechanisms? Give examples of each.
8. What is a founder effect?
9. In U.S. mountains why do plant and animal communities tend to have higher elevational limits on south-facing slopes and lower elevational limits on north-facing slopes.
10. What is meant by the term "gross primary production"? How does it differ from "net primary production"? Which type of productivity measure is used in calculating P/R ratios?
11. Distinguish between polygynous and polyandrous mating.
12. Briefly, what is sociobiology?

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Session II. Longer factual essays. Answer two of the four questions.

1. Systematists use at least three definitions of a species. Define each to show how they differ. What is the goal of users of each definition?
2. Is there any utility in applying the designations of "r-selected" and "K-selected" in attempting to understand population dynamics? Give examples of how these designations provide or do not provide useful understanding and predictability.
3. Select one of the current schools of phyletic inference. Describe its assumptions, methodologies and the major criticisms against it.
4. Outline the factors involved in both ecosystem structure and function.

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Session III. Data analysis. Select one of three questions.

1. Below are the results of selection experiments. The values in the table are fitnesses of the genotypes:

% at start	AA	Aa	aa	
.70	.44	.68	1.00	
.50	.77	.94	1.00	
.30	1.00	.89	.83	
.15	.97	1.00	.40	

What were the assumptions implicit in setting up the experiment in this manner. What types of selection are occurring? Estimate the equilibrium frequency of allele A.

2. The following data are available for the forest community:

Tree Species	Shade Tolerance of Seedlings	Stem Density per Hectare	Basal Area* (sq. m/hectare)	
A	low	100		25
B	low	150		30
C	high	10		5
D	high	30		8
E	low	200		15
F	high	25		5
G	medium	20		2
total		535		90

\*Size at 1.5 m above the ground

In what stage of succession (early, middle, late) is this community? Explain your answer.

Which tree species would be the dominants during each of the stages of succession?

Given these data calculate an index of dominance for each species in the current community. Explain why your index has ecological merit in describing this community.

Which individual species is likely to have the most rapid growth rate? The slowest growth rate? Explain your answer.

3. There is no set answer to the following question. Your analysis and approach is important here.

The following is a set of data on five taxa (and the characters which are distributed among them) are to be utilized in developing a hypothesis regarding their relationship.

TAXA	CHARACTERS												
	1	2	3	4	5	6	7	8	9	10	11	12	13
A	1	0	0	0	0	1	0	1	1	0	0	1	1
B	0	1	0	0	0	1	0	1	1	0	0	1	1
C	0	0	1	0	0	1	0	0	0	1	1	1	0
D	0	0	0	1	0	1	1	0	0	1	1	1	0
E	0	0	0	0	1	1	1	1	0	1	1	1	0
F	0	0	0	0	0	1	0	0	0	0	0	0	1

There are thirteen characters. Zero represents the primitive state. One represents the advanced state. Construct a phylogeny for the six taxa pointing out the significance of each character in your analysis. Define all terms that you use.